placed them in a cauf, and have never had one die from the change. The change to fresh water undoubtedly hastens the metamorphosis into the *Amblystoma* form, as I have noticed quite a change in the course of twenty-four hours in individuals placed in the cauf, while an equal number kept in the alkali water in the boat have shown no change in any of them in several days. I have kept six at different times in jars of fresh water until they have completed their metamorphosis. I made no systematic note of appearance from day to day, but my observation was careful and regular. In two cases the change in external appearance was so abrupt that I would have been almost certain that another salamander had been substituted for the one in the jar had I not had him so completely under observation that it was impossible. The gills had assumed a stubby form about half the length that they were the night before, and the gill on the back on the back of the body was nearly half gone; it took air quite often, and I removed it from the jar and placed it in a box with some lake grass around it to keep it moist. It completed the metatmorphosis in a few days. I did not feed it any during this time. While it was in the jar it was well fed with flies. The jar was placed upon a table in the telegraph office. The flies at first had to be pushed in front of it with a pencil. It finally got to know that tapping the jar with a pencil meant a fly, and would rise to the surface immediately and snap at whichever it saw first, pencil or fly. It furnished train-men continual amusement while here, and they kept it constantly gorged. Those that I kept well fed in jars and seldom changed the water, say once in three days, usually began to show a slight change in from two to three weeks, and all of them completed the change into the *Amblystoma* inside of six weeks, while I have had but three changes of those kept in the cauf (sixty of them) in three months. During that time they have not been fed at all. The *Siredon mexicanus* is said to never undergo the transformation in its home, and Professor Marsh doubts that it ever makes it here. This doubt I can put at rest. They do make the change here, and in large numbers. During the latter part of the month of July and the entire month of August, if the day is rainy or misty, they come from the lake to the shore in large numbers, and secrete themselves under some piece of wood or rock where they can keep moist. Sometimes they venture out in a shower, and the sun catches them before they can obtain shelter either in the lake or under cover, and in a few minutes kills them. They can be found dried hard anywhere about the lake, on the shore or in the grass. While catching *Siredon* I have seen and caught a number of *Amblystoma* in the lake, with the metamorphosis, as far as I could see, as complete as those we find half a mile from the lake. They cover the ground by thousands during a warm summer rain, coming from every conceivable place where they could have found shelter, from under rocks, boards, old ties, and out of gopher holes. I have a cat that eats them greedily. She has fished several out of jars on the table and devoured them during the night when there was no one to watch her; and I am told by a resident that the numerous skunks that live around the lake live principally on them. They are of two colors, a blackish green and a yellowish green color. I have had two of the blackish green complete the change in sequence, while one of the yellowish green was completing it under the same circumstances of change of water and food. I think this will be found to be the result in all similar cases. I have caught them in all stages of growth and in all stages of their changes into the *Amblystoma* state. During the months of July and August they lie close to the shore of the lake, where it is shallow; but after the first frost they disappear completely, or at least I have never been able to find them. I think they must bury themselves in the mud at the bottom of the lake, as I have stirred up the grass often and have not seen them issue from it.

AN ANALYSIS OF WATER DESTRUCTIVE TO FISH IN THE GULF OF MEXICO.*

BY F. M. ENDLICH.

Having completed the examination of sea-waters from the Gulf of Mexico, so far as the scant supply would permit, I have the honor to offer the following report thereupon, the water in which the fish die being designated as A, the good water as B:

	A.	B.
Specific gravity	1.024	1.022
Solid constituents (total), per cent	4.0780	4.1095
Ferric compounds, per cent	0.1106	0.0724
Injurious organic matter	ratio=3	ratio=2

I find that the water A contains a large quantity of *Algæ* and *infusoria*. It is eminently probable that the former may have had an injurious effect upon the fish. Specimens of the algæ have been submitted to Professor Goode, who will send them to some expert, in order that their specific gravity may be determined.

The "dead fish" in possession of the United States National Museum are such that any examination of the organs of respiration will be of no avail.

I cannot find, even by spectroscopic analysis, any mineral constituents in the water A which could noxiously affect the fish.

In my estimation the death of fish was caused by the more or less parasitic algæ, which are found in large quantities in water A, but do not occur at all in water B.

In case the same phenomenon should recur, the presence of an expert in the questions involved, more particularly chemistry and botany, would most likely lead to definite results,

Prof. S. F. BAIRD,
Secretary the Smithsonian Institute,
WASHINGTON, D. C.

A MICROSCOPICAL STUDY OF THE IRON ORE, OR PERIDOTITE OF IRON MINE HILL, CUMBERLAND, RHODE ISLAND.†

BY M. E. WADSWORTH.

The attention of the writer was first particularly called to this formation by some specimens presented to him by Mr. H. B. Metcalf in the Spring of 1880. These did not appear to the writer to be any common ore of iron, but rather fragments of a basic eruptive rock containing much iron. Sections were accordingly made which revealed its true character.

The formation was described by Dr. Charles T. Jackson in his report on the Geological Survey of Rhode Island in 1840. He states that Iron Mine Hill "is a mountain mass of porphyritic magnetic iron ore, 462 feet in length, 132 feet in width, and 104 feet in height above the adjoining meadow. From these measurements, which were made over only the visible portion of this enormous mass of iron ore, it will appear that there are 6,342,336 cubic feet of the ore above natural drainage. ... Its specific gravity is from 3.82 to 3.88.... This ore is remarkable both on account of its geological situation and its mineralogical and chemical composition. It appears to have been protruded through the granite and gneiss at the same epoch with the elevation of numerous serpentine veins which occur in this vicinity. This will appear the more probable origin of this mass, when we consider its chemical composition in comparison with that of the iron ore, which we know to have been thrown up with the serpentine, occurring on the estate of Mr. Whipple, and the fact that the ore at Iron Mine Hill is accompanied by serpentine mixed with its mass in every

* From the Proceedings of United States National Museum.

† From the *Bulletin of The Museum Comparative of Zoology*.—Harvard College.

part, gives still greater reason for this belief." (*l. c.*, pp. 52, 53.)

He gives as the result of his chemical analysis of the "Porphyritic Iron Ore from Iron Mine Hill, Cumberland," the following (*l. c.*, p. 53):—

SiO_2	23.00
Al_2O_3	13.10
Fe_2O_3	27.60
FeO	12.40
MnO	2.00
MgO	4.00
TiO_2	15.30
H_2O and loss	2.60
Total	100.00

In 1869 the Rhode Island Society for the Encouragement of Domestic Industry published a report relating to the coal and iron in Rhode Island, from which we glean the following. The iron ore is regarded as practically inexhaustible, the mass at Iron Mine Hill visible above drainage being estimated at two millions of tons.

"It is also conceded, as regards quality, that the Cumberland ore is free from sulphur and phosphorus, the most common and worst impurities, and that it contains manganese, the most prized of all the elements found in connection with iron. For these reasons the Cumberland ore is sought by manufacturers at a distance, to mix with softer ores and improve their quality, and is now exported from this State for that purpose."

It seems that this Iron Mine Hill ore was employed in 1703, mixed with the hemitite of Cranston, R. I., for the casting of cannon. The work was done at Cumberland, and, in part at least, "the cannon used in the celebrated Louisburg expedition, in 1745," were cast from these ores. The manufacture was abandoned in 1763, owing to an explosion of the furnace, by which the proprietor was killed.

During the administration of John Adams the same ores were also used for the manufacture of cannon. It seems that the Cumberland (Iron Mine Hill) ore was employed in the manufacture of charcoal iron at Easton, Chelmsford, and Walpole, Mass., as late as 1834. "The Cumberland ore, mixed with equal quantities of Cranston hematite or bog ore, produced, for a long period, a charcoal iron unsurpassed in this country. . . . The Cumberland ore contains an uncertain percentage of titanium, which, while it improves its quality, helps make it refractory. The ore is porphyritic, the magnetic oxide being associated with earthy minerals, principally feldspar and serpentine." It would seem that in 1869, and before, the ore was largely shipped to Pennsylvania to mix with other ores.

A letter of Professor R. H. Thurston, published in this report, states: "The Cumberland iron ore is of the kind known to mineralogists as 'ilmenite;' among metallurgists as 'titaniferous magnetic ore,' and iron manufacturers, on account of its peculiar value for producing steel, would term it a 'steel ore.' . . . The Cumberland ore is conveniently located and of inexhaustible extent; it is perfectly free from noxious elements, though somewhat refractory; it will furnish a very strong iron or a most excellent steel; it can be smelted within the State at a profit; it can be made directly into steel at a much greater profit; steel made from it will bring the highest prices in the market."

Professor Thurston states that the mean of various analyses made of this ore is about as follows:

SiO_2	22.87
Al_2O_3	10.64
Fe^2O^3 / FeO	44.88
MnO	2.05
CaO	0.65
MgO	5.67
TiO	9.99
Zn	0.20
H_2O and loss	3.05
Total	100.00

The ore on one side of the hill, where it has been most extensively quarried, shows a dark, somewhat resinous groundmass, holding large striated crystals of feldspar. The resinous lustre and greenish-yellow color, as observed under the lens, are caused by the presence of olivine. The olivine becomes more strongly marked on the slightly weathered surfaces seen on the faces of the quarry. Under a lens of high power, the olivine shows clearly on the fresh fractures. The olivine in weathering decomposes to a yellowish and reddish-brown ferruginous powder, leaving the other constituent of the rock, the magnetite, well marked. The magnetite decomposes more slowly, and forms an incoherent mass after the decay of the olivine. The rock gelatinizes with hydrochloric acid, and yields a titanium reaction. A fragment allowed to stand a day or two in weak hydrochloric acid yielded gelatinous silica copiously.

A section made with special reference to the feldspar crystals shows large porphyritic crystals of the latter enclosed in a mass of magnetite and olivine.

The magnetite forms irregular, more or less connected masses, making a sort of sponge-like structure. Its rounded and irregular cavities are filled with olivine, which also occupies the interspaces between the magnetite masses. The olivine is in rounded forms, which sometimes show one or more crystal planes. It is cut through by numerous fissures, that usually show a ferruginous staining along their sides. The olivine also holds grains of the magnetite. Except the fissuring and ferruginous staining, the olivine is comparatively clear, and shows little signs of alteration.

The plagioclase feldspar shows well-marked lines of cleavage and fracture, and is somewhat kaolinized along these lines. It contains a few irregular flakes of biotite together with grains of olivine and magnetite.

The order of crystallization appears to have been, first the magnetite, then the olivine, and lastly the feldspar.

This rock is similar to the celebrated iron ore of Taberg, Sweden, as described by A. Sjören in the Geologiska Föreningens Forhandlingar (1876, III. 42–62; see also Neues Jahrbuch für Mineralogie, 1876, 434, 435.) The Taberg rock has been worked as an iron ore for over three hundred years. This Swedish ore is called by Sjören "magnetite-olivinite."

The feldspar is confined to the peridotite found on one side of the hill, where the peridotite passes into a compact greenish-black rock, showing patches of serpentine and grains of magnetite. From this fact it seems necessary to regard the feldspar as abnormal and local in the rock, which in general is composed of olivine and magnetite or their alterative products.

The structure remains about the same in the non-feldspathic portions as it is in those before mentioned as holding feldspar. But the olivine is entirely changed to a greenish serpentine which shows beautiful fibrous polarization. The serpentine retains the form of the olivine grains, their inclusions, and the network of fissures before mentioned. In some of the sections considerable carbonate was seen, presumably dolomite. In one section part of the olivine grains, especially towards their interior, remained unchanged, but on their edges they were altered to serpentine. Another change was observed here: the formation of secondary crystals of irregular outline that belong probably to actinolite. Some are elongated and narrow; other are short and broad, traversed, by cleavage planes. They evidently belong to the monoclinic system.

The origin of this rock could not be told from its field relations, as its contact with any other rock could

not be found. Since the only method in which its origin can be absolutely shown cannot be used without expensive excavation, it only remains to give the probabilities so far as ascertainable from the mass itself. Such microscopic characters and mineral association have been, so far as we know, only found in eruptive rocks when the origin of such rocks has been studied with sufficient care to determine it. Hence we must conclude it is most probable that this mass is eruptive also, until found to be otherwise.

It closely resembles in structure and composition some of the meteorites, except that its iron is oxidized and not in a native state—a resemblance which for others of the peridotites has long been pointed out. It is rocks of this character, as has been suggested by others, that give us the most probable clew to the interior composition and structure of the earth.

The rock in the field shows, to our mind, no signs of structural planes that should be referred to sedimentation. On one side the rock is massive and jointed, and on the other it is jointed in fine parallel planes. This portion of the rock is more highly metamorphosed than the other, and, as is usual in highly altered eruptive rocks, joints parallel to certain lines of pressure occur. The writer has seen this structure in many rocks that were indisputably eruptive, forming well marked dikes in other rocks.

A rod away from the main mass of the iron ore, near one end, some serpentine appears that cannot be directly connected with the other peridotite. Microscopically its characters and structure are the same as the main rock, and there is no reason to regard it as distinct. The rock nearest to the peridotite is a mica schist some hundred feet away. It shows no characters that would indicate the transition of the ore into it.

The locality was visited by the writer in October last, in company with Professor A. S. Packard, Jr., of Brown University, and Mr. T. S. Battey, of the Friends' School, Providence, R. I. To the latter gentleman I am especially indebted for a copy of the paper of the Rhode Island Society before mentioned, and for other favors.

This examination may serve as an illustration of the aid that microscopical lithology may be to the practical side of life, since now, for the first time since this rock has been worked, can the ironmaster who wishes to use it approach understandingly the metallurgical problems it presents; whether he desires to employ the rock as a whole, or to concentrate the magnetite first.

In direct-vision spectroscopes the number of prisms involves a considerable loss of light. M. Zenger now uses a liquid prism of ordinary form, having attached on its anterior plane a quartz prism of the same refringent angle, but arranged in opposite direction. The posterior face of the liquid prism carries a plane parallel plate. The rays fall normally on the quartz. The loss of light is by this arrangement reduced to a minimum. The spectra obtained are very intense, and the lines are well defined. A single parallelepiped of the kind decomposes the D line to the naked eye, and with a small Galilean telescope, magnifying five times, one can distinguish the difference of breadth of the two lines, and easily see the extreme red and ultra-violet rays, though there are only two prisms of 60 degrees.

M. Poliakoff, the distinguished Russian naturalist, has examined a horse presented by Colonel Prejvalsky to the St. Petersburg Academy, and decides it to be a new species, which he has named *Equus Przewalskii*. A translation of his memoir appears in the "Annals of Natural History," and from this it appears that the new representative of the family of undivided-hoofed mammals is in some respects intermediate between our domestic horse and the wild ass, but it differs from the asinine genus in having four callosities, one on each leg. In the form of skull, absence of dorsal stripe, and other particulars it resembles the domestic horse. This newly-recorded animal is indigenous to the plains and deserts of Central Asia, and has not hitherto fallen under the dominion of man.

COMET (*b*), 1881.

We continue the interesting series of sketches of this comet, made by Professor Edward S. Holden with the 15-inch equatorial at the Washburn Observatory, Madison, Wisconsin.

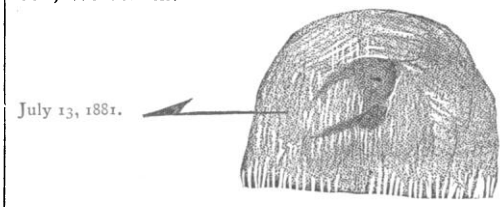

Figure 1.

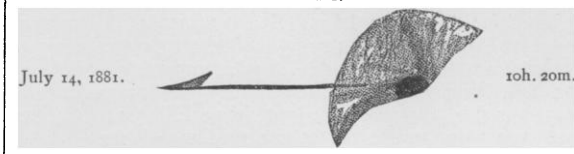

Figure 2.
Moonlight.

Figure 3.

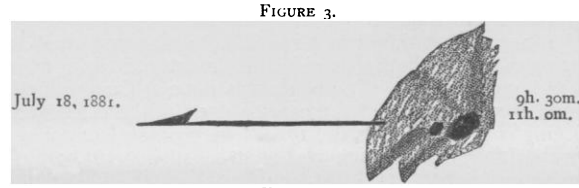

Figure 4.

The nucleus is DOUBLE (it has not been previously) $p = 275^{\circ} \pm$, $s = 1''.5$, with a dark space between the parts.

DO WE SEE NON-LUMINOUS BODIES BY REFLECTED LIGHT?

By A. G. Gaines, Pres. St. Lawrence University, Canton, N. Y.

All who have treated this subject have answered the above question with an unequivocal *yes*.

It may appear presumptuous to call the answer in question. Nevertheless, while reflecting recently on some of the peculiar facts of light and vision the thought came to me to doubt this universally accepted proposition; and now I wish to express my more confirmed doubts, and give some reasons for thinking we must revise our views on this point to some extent.

What I now hold is that neither *transmitted* nor *reflected* light reveal to us in vision either the body transmitting or the body reflecting, but that *radiant* light does reveal in vision the radiant body, and that the light by which any non-luminous body is visible is essentially of the nature of radiant light, and is properly to be so called. Paradoxical as these views may seem on bare statement, I think that a little consideration of the facts involved will soon convince us that they must be accepted as true, and show us that the present paradox is due to the illusions of an erroneous point of view.

It is a known and universally accepted truth that *transmitted* light does not reveal the transmitting medium. It may be refracted, little or much, but when it reaches the eye it reveals, not the refracting medium, but the body from which it was emitted. The refracting or transmitting body may be *visible*, but is not visible by transmitted light. Were it perfectly transparent, that is, were it to transmit *all* the light coming to it, it would be invisible. This is no new truth, but one universally held and taught; and thus far we are all agreed.